Implementation of a coupled land-atmosphere modeling system within a northwestern Mexican river basin.

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Outline

1) **Study motivations.**
2) **Study objectives.**
3) **WRF/WRF-Hydro modeling system**
4) **Model experiment setup “standalone”.**
5) **Study área.**
6) **Preliminary results.**
7) **Continued work.**

2. STUDY MOTIVATIONS

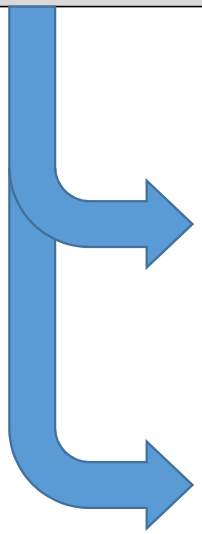
Heavy rainfall events and their consequent floods are of growing concern, due to the significant damage to infrastructure and often fatalities.

The importance to develop reliable forecasts of rising streams and rivers in real-time and that are reliable, are becoming of most importance for emergency planning and decision making.

The necessity of producing high resolution hydrometeorological information such as runoff, river stage, soil mositure, etc., for flood forecasting.

2. STUDY OBJECTIVES

Implement the use of the WRF-Hydro, a hydrometeorlogical modeling system, conformed by a numerical weather prediction model as well as a fully distributed hydrologic and hydraulic model, in simulating a flood event caused by heavy rainfall over a northwestern Mexican basin.



Evaluate the performance of the WRF-Hydro system both coupled and uncoupled, with calibrated parameters and and model validation.

Asses model performance by comparing observed and simulated variable: precipitation, streamflow, and soil moisture.

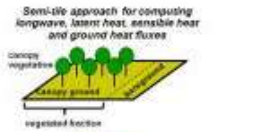
3. WRF/WRF-Hydro modeling system

WRF-HYDRO

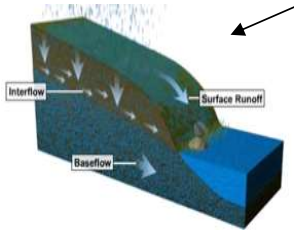
- Multi-scale and multi-physics
-Coupled/standalone mode

NOAH MP LSM

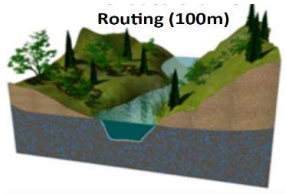
a land surface model (LSM) using multiple options for key land-atmosphere interaction processes.



Noah-MP



Surface and subsurface routing



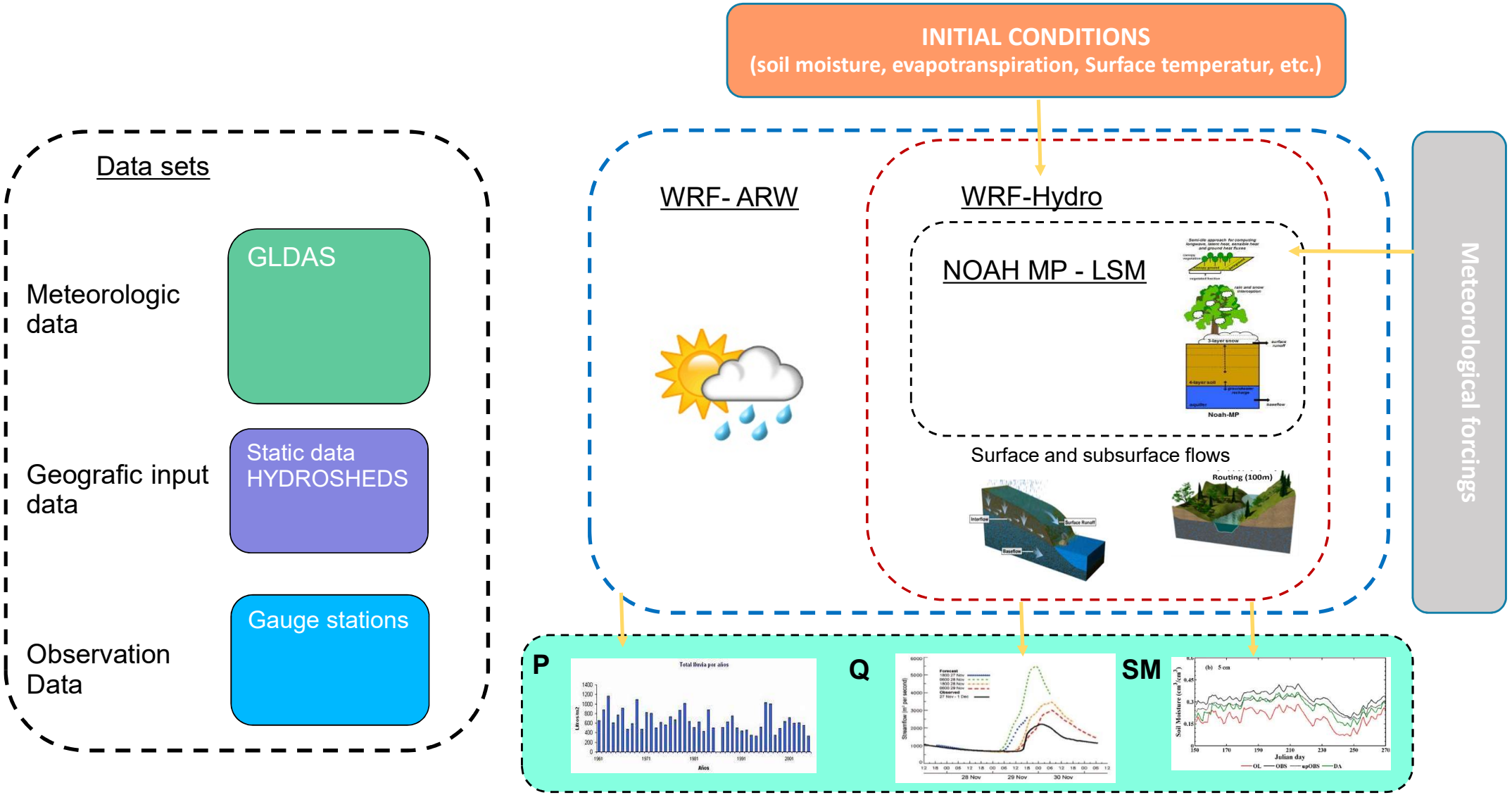
Channel network

WRF-ARW

Weather Research and Forecasting (WRF) Model

Widely used regional atmospheric model in mesoscale weather research and forecasting, representing a wide variety of precipitation processes.

3. WRF/WRF-Hydro modeling system



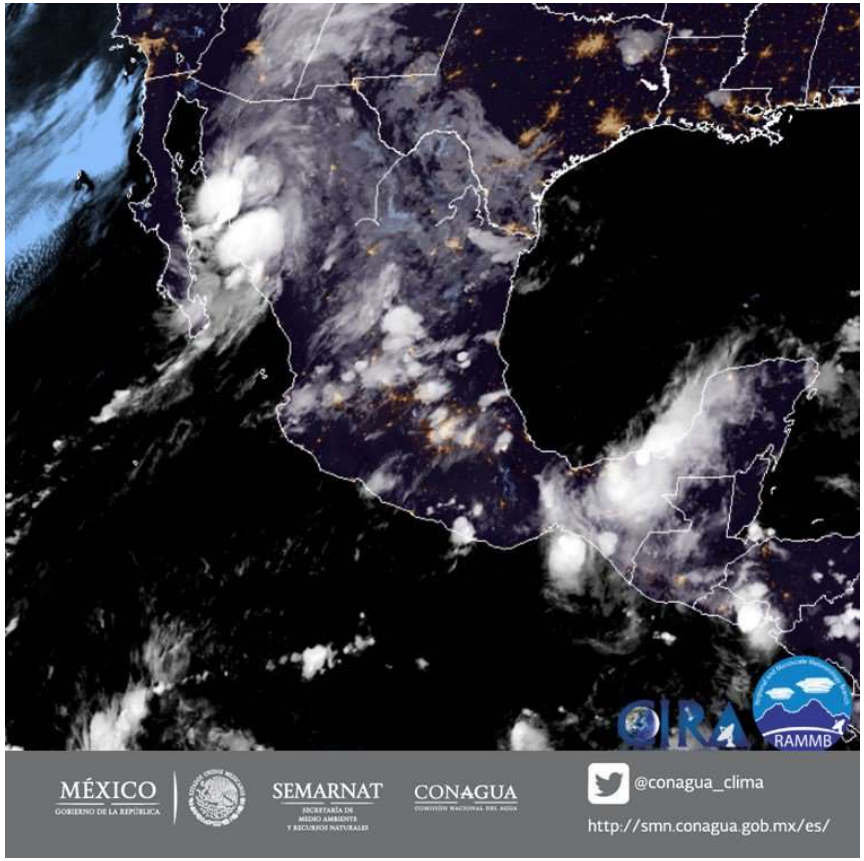
4. Model experiment setup “standalone”.

WRF-Hydro implementation to traditional 1D Noah MP LSM of WRF in a “standalone” manner, providing surface overland flow, saturated subsurface flow, channel routing, and baseflow processes.

Model	WRF-Hydro 3.0 ver.	
Domain	1	
Period of event	00 UTC 19 SEP 2018 – 21 UTC 21 SEP 2018	
Land Surface Model	NOAH LSM MP	
Horizontal resolution	1.0 km	HIGH RESOLUTION: 250 m
Number of grid points	449 X 449	1789 x 1789
Integral time	3HR	

4. Flood Case

Tropical Depresion 19-E
(19–20 Sept.2018)



https://www.google.com.mx/imgres?imgurl=https%3A%2F%2Fwww.debate.com.mx%2F__

4. Flood Case

- **8 fatalities.**
- **300,000** home properties affected.
- **$800 mil** economic loss in agriculture and infrastructure.

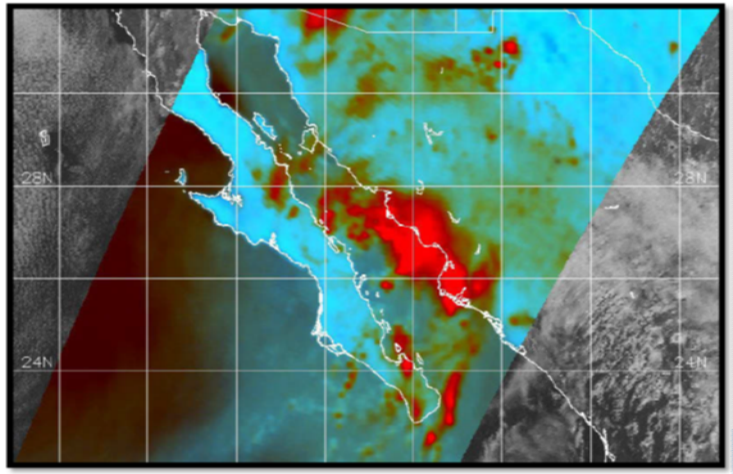
Meteorological conditions of event

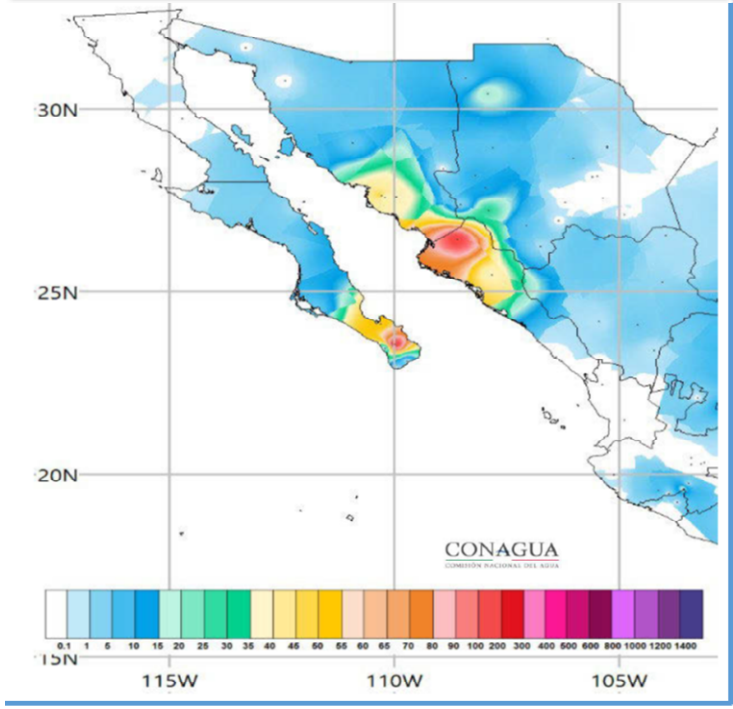
Superposition of meteorological phenomena:

- Tropical wave
- Low pressure system at low to mide atmospheric levels.
- A profound column of humid conditions.

Total precipitation observerd during the event was 394 mm, at Ahoem, Sinaloa.

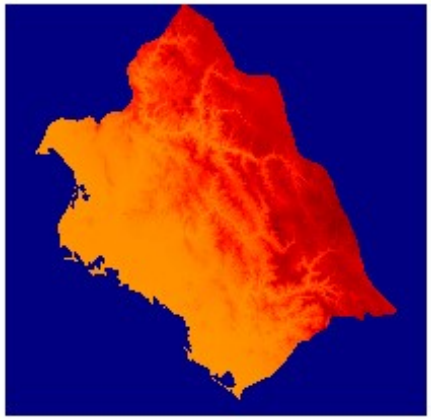
https://www.nhc.noaa.gov/satellite.php



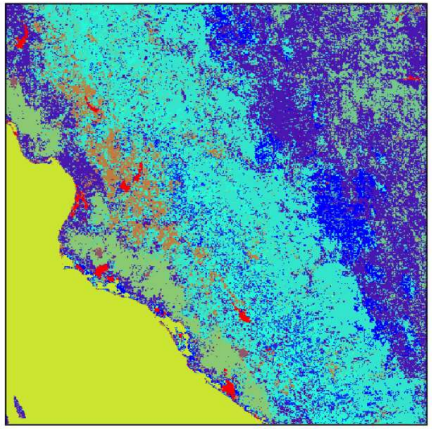


https://smn.conagua.gob.mx/es/

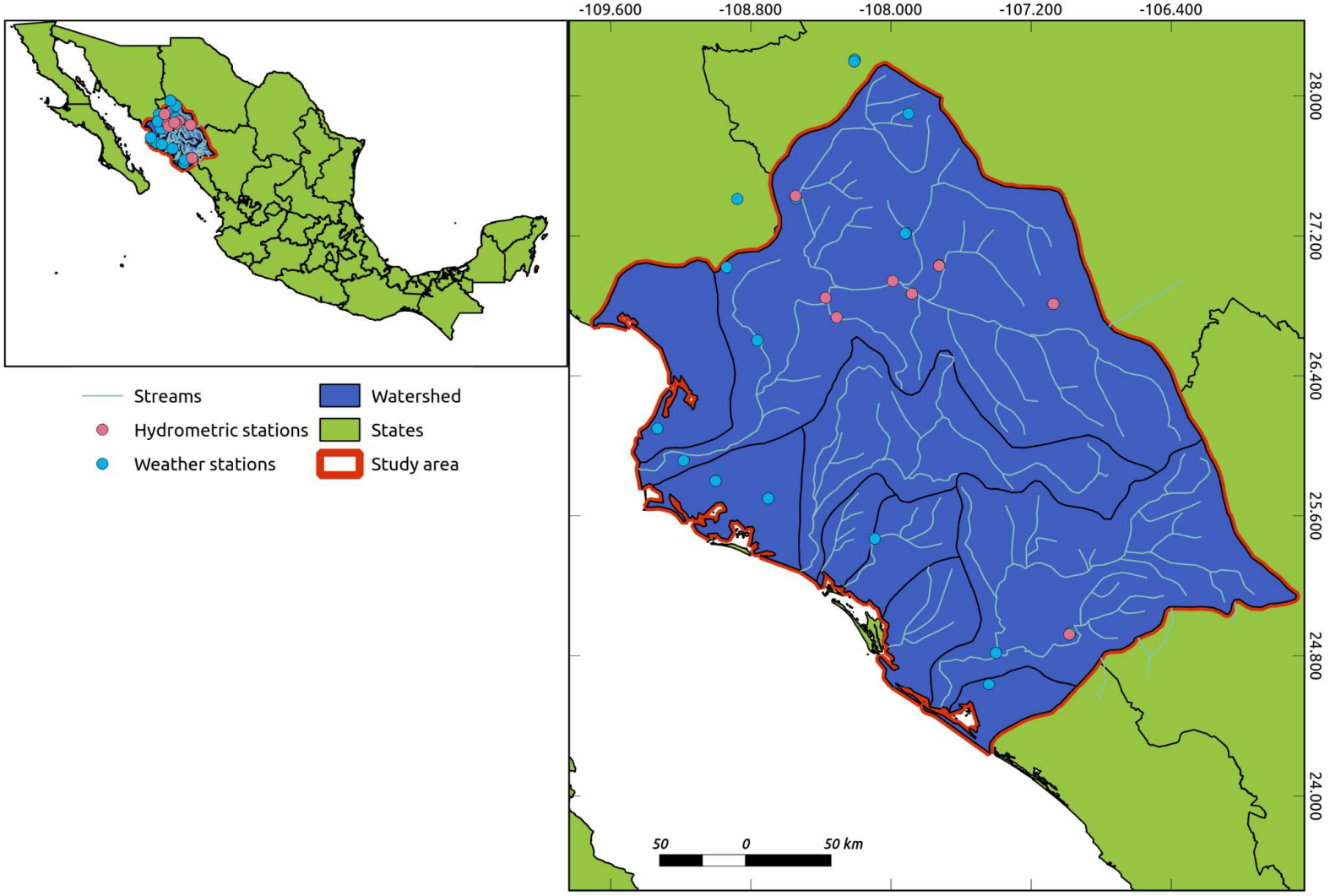
5. Study area



Domain high resolution topography.

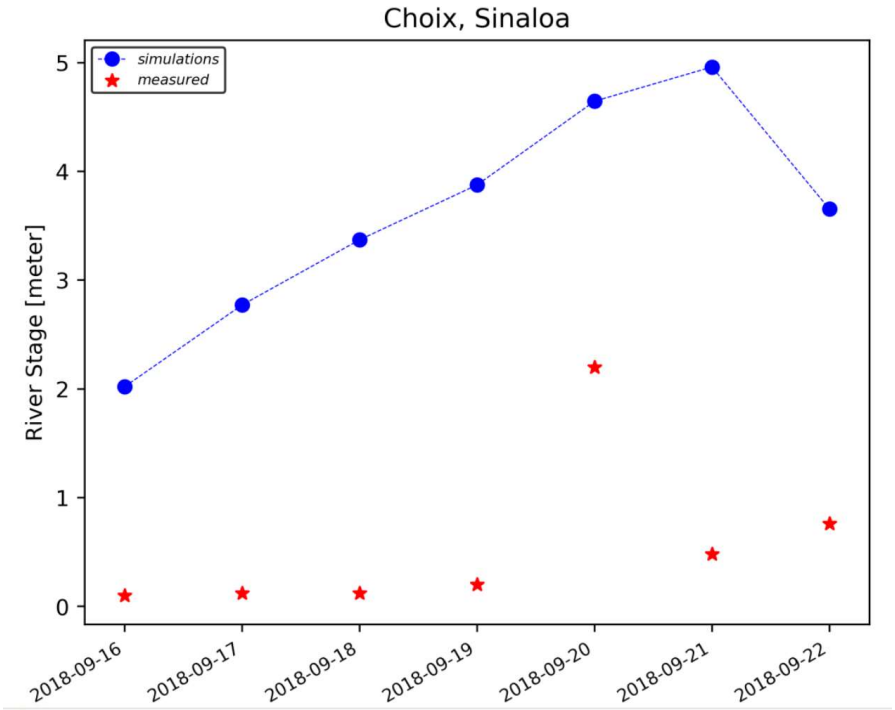


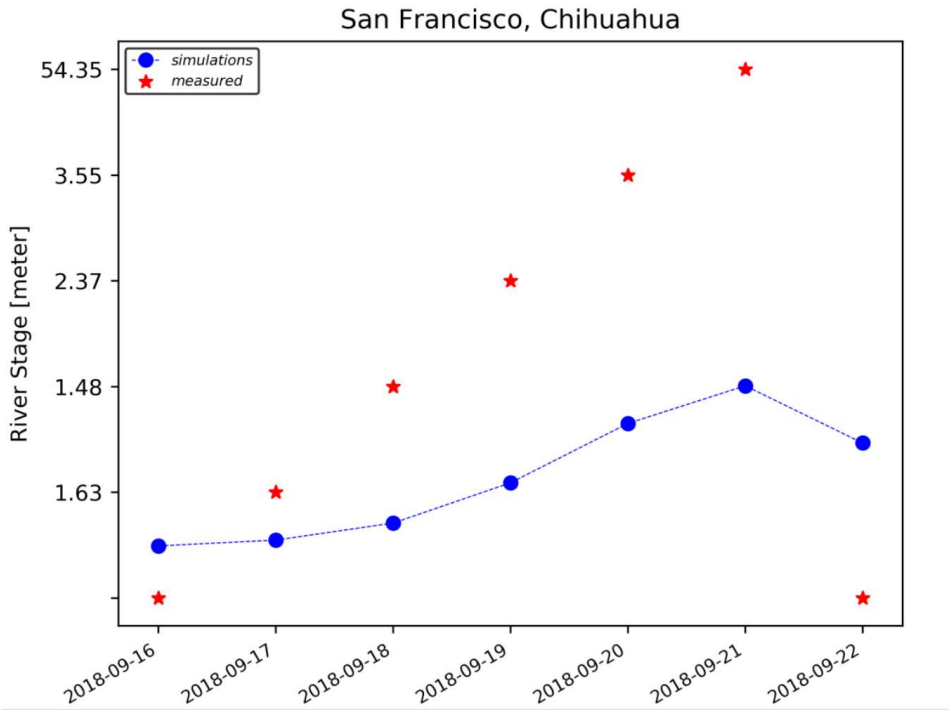
Domain land-use.



6. RESULTS

5.1.Deterministic simulation: model output vs. data observation





Daily measured data for both hydrometric stations with continous data.
The model underestimates river stage from observed data in station San Francisco, Chihuahua, that is upstream from Choix, Sinaloa.

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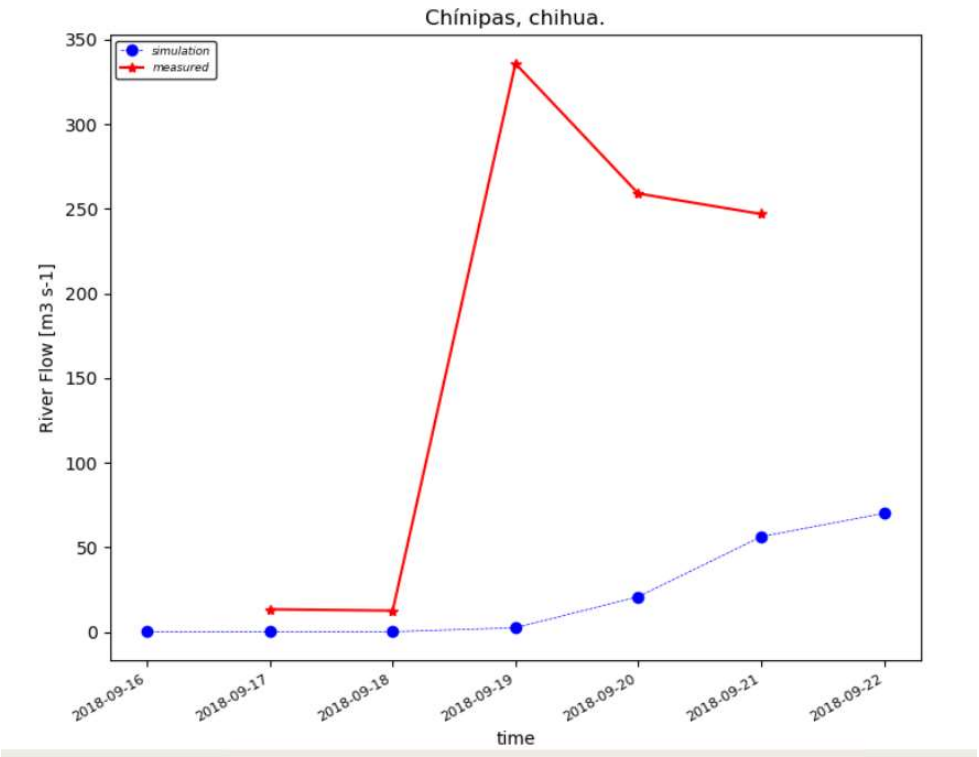

The model underestimates river flow from observed data in station Chinipas, Chihuahua., station is also upstream from Choix, Sinaloa.

7. CONTINUED WORK

- Model calibration with a stepwise approach (Yucel et.al., 2015).

  Parameters controlling the total water volume: infiltration factor, REFKDT, and surface retention depth, RETDEPRT).

  Parameters controlling temporal distribution of streamflow: surface roughness (OVROUGHRT) and channel Manning roughness (MANN).

- Model validation.

- Fully coupled WRF/WRF-hydro simulations.

- Ensemble simulations.